Washeteria and Health Clinic Fire Protection in Alaska- Vol. 2

FINAL SUBMITTAL

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1. GENERAL

A. Scope of work: the purpose of this report consists of two parts - to further investigate fire protection alternatives for washeterias, and to evaluate fire protection considerations for health clinics in rural Alaska.

B. Report process: this report follows a previous report titled “Washeteria Fire Protection in Alaska” dated 6/16/03 and also prepared by PDC. Volume 2 (this report) will go into further detail on selected topics for washeterias, and will provide background analysis for clinics. Information was collected from ANTHC (Alaska Native Tribal Health Corporation) regarding various topics – prototype floor plans, construction methods, and electrical power supply reliability.

C. Goals and objectives: it is hoped that this report can be used to establish some details of recommended additional fire protection features for washeterias. These specifics would allow these new systems and features to be added to new and existing construction. A secondary goal is to also consider requirements and recommendations to improve fire protection of rural health clinics.

2. PASSIVE FIRE PROTECTION FEATURES

A. General: the previous report (Washeteria Fire Protection) made recommendations to increase the passive fire protection features of the facilities. These recommendations included reduction or elimination of combustible finishes, and protection of structural members with rated assemblies to meet a higher standard of passive fire protection. Reduction of combustible finishes, and achieving rated assemblies can be accomplished in a number of ways. These ways include conventional rated assemblies using gypsum products, and application of protective coatings. A possible goal would be to improve the construction type from a "non-rated" to a "rated" category, such as moving from Type V-B to Type V-a (IBC). These two alternatives are discussed in more detail below.

B. Rated assemblies: these constructions are used for a variety of purposes. They are used to protect structural components in a fire situation, to separate portions of a building from one another in the event of a fire, or to isolate a hazard. The International Building Code describes a type of rated assembly as a "fire barrier" and defines it as "A fire resistance-rated vertical or horizontal assembly of materials designed to restrict the spread of fire in which openings are protected." If washeteria construction were to be upgraded from its minimum permitted type of V-B to V-A, the difference would be the addition of fire barriers at the following locations: structural frame, bearing walls, floor construction, and roof construction. Each of these building elements would have to be protected to a fire resistance rating of 1 hour (per 2000 IBC, Table 601). Examples of various construction methods for rated assemblies can be found in Table 719.1(2) of the IBC. Note that if assemblies are rated, opening may need to be protected in accordance with the code as well. Another particular area of interest for washeterias is the soffit below the building; in the past, the finish of the soffit has been conventional plywood which constitutes a risk of both fire spread and an entry point into the building for fire originating outside the structure. Addressing this issue does not necessarily require a rated assembly, but a non-combustible finish is preferred. One of the products discussed for application in this situation is G-P Gypsum ToughRock Soffit Board.

C. Fire retardant applications: an alternative to gypsum based products for reducing combustible finish exposure, and for fire ratings are sprayed on fire retardants. They have a number of advantages which can include increased speed and reduced cost of application in the field. One example of a product which has been used in rural Alaskan applications in the past is Firefree 88 from International Fire Resistant Systems. Some of the advantages and disadvantages of this type of product are listed below. One issue to consider is that per the IBC, special inspection of the

application of fire resistant materials is required if the material is applied to structural members or decks. This could make its application in remote areas more expensive.

i. Advantages of spray applied fire resistant material:
   (1) Speed of application in the field.
   (2) Reduced cost of field application.
   (3) Allows for flexibility in component arrangements and changes in the field.

ii. Disadvantages of spray applied fire resistant material:
   (1) More fragile than other more substantial rated assemblies.
   (2) Requires specific thickness of application so is subject to quality control needs and some testing.
   (3) Material costs may be relatively high.
   (4) There may be limitations on when and how the material is applied (temperature, wind, humidity, etc.).
   (5) Some products are not designed for exterior use, or may not be applied to some surfaces (structural steel for example).
   (6) Materials are subject to storage limitations (some products cannot be frozen for example).
   (7) May require special inspections per 2000 IBC 1704.11 if applied to structural members or decks.

3. ACTIVE FIRE PROTECTION FEATURES

A. Fire Detection and Alarm Systems: we recommend detection in all spaces of the building to NFPA 72 criteria (National Fire Alarm Code). Due to potential problems with products of combustion (smoke detection) in certain spaces, heat detectors are recommended for spaces exposed to cold outside air like entryways, and for spaces with the potential for high humidity like restrooms or showers. Using products of combustion detection in other spaces like offices will allow for earlier warning of an incipient fire.

B. Sprinkler system criteria: although there has been some discussion of the use of residential standards for sprinklers for washeterias, the application is clearly outside the scope of the residential standards and is not recommended. We recommend the application of NFPA 13 – the Standard for the Installation of Sprinkler Systems. This standard is somewhat more conservative but has requirements and approaches that would address the spaces appropriately. We recommend that a wet pipe sprinkler system be applied. This is the simplest, least expensive, and most reliable of the system choices. Where cold spaces need to be protected, dry sidewall or dry upright sprinkler heads could be used and connected to the wet pipe sprinkler system. To avoid the need to provide sprinkler protection above the ceiling or below the floor (in the attic and sub-floor spaces) we recommend that the materials be fire retardant treated, or that joist construction be fire stopped in accordance with NFPA 13 requirements. For the sprinkler hazard classification, we recommend that the NFPA 13 ordinary hazard, group 1 be used as it seems to fit the use most closely (such as for laundries). This hazard classification leads to a sprinkler application rate of at least 0.15 GPM/square foot over a 1,500 square foot area. To reduce the water demand, and to speed the response time, we would also recommend quick response sprinkler heads. This reduces the minimum operating area to only 900 square feet. The resultant nominal flow rate is approximately 135 GPM; the actual required rate when adjusted for installed conditions would likely be more like 200 GPM. This adjustment takes into account that the minimum density/flow rate is never the actual discharge amount. Due to inefficiencies of the layout, overlapping coverage, and increasing upstream pressure (above that minimum requirement), the actual flows are always greater than the minimum flow rates.

C. Water storage criteria: NFPA 13 requires storage for 60 to 90 minutes for hydraulically calculated ordinary hazard sprinkler systems. In some cases washeterias are co-located with water storage tanks and substantial water for fire protection is available. The remainder of this discussion concerns the case where water storage is not already present such as for water

treatment. If this 60-90 minute criteria was used for the actual minimum flow rate discussed above, a water storage tank would need to be sized between 12,000 and 18,000 gallons. An alternative criteria for water storage that is sometimes applied is the FM (Factory Mutual) criteria of 10 minutes, which is used where the primary criteria is property protection. This would yield a required actual storage quantity of around 2,000 gallons – a figure that would achievable for a small rural facility. This alternative criteria would have to be discussed with and approved by the authority having jurisdiction. The adoption of the alternate water storage criteria could reduce costs substantially. To simplify the system and reduce cost, an atmospheric storage tank is suggested.

D. Fire pump criteria: NFPA 20 is the recognized standard for fire pumps, and is titled "Standard for the Installation of Stationary Pumps for Fire Protection". This document outlines requirements for the type of fire pump, the design, and the installation of fire pump systems. One of the initial design decisions when a fire pump is needed is the choice between electric fire pumps and diesel engine driven pumps. If the power supply to the facility is "dependable", then an electric driven pump is acceptable. When the power supply is not dependable, NFPA 20 dictates a diesel engine pump be applied for reliability. NFPA 20 no longer provides specific guidelines as to what constitutes a reliable power supply, and instead leaves that determination to the authority having jurisdiction. Following are some facts about power supply based on information provided by ANTHC on AVEC power plants.

   i. Average number of power plant shutdowns per plant for 2002: 19. The range for various communities is from 0 to 77 interruptions per year.
   ii. Average total hours of interruption time per customer per year for 2002: 10.6. The range for the various communities is from 0 to 43 hours per year. For comparison purposes, Chugach Electric customers experienced 2.45 hours of average outage time during 2002.
   iii. Fire pump selection conclusions: as noted above, the determination as to reliable electric power comes from the authority having jurisdiction, but the average AVEC rural customer is out of power for less than 11 hours per year, which could be evaluated as reliable. For locations where the number of outages and outage periods are higher, diesel engine driven pumps may be more appropriate. Since diesel engine drives result in additional interior fuel storage, another potential source of ignition, a more complex installation, and additional maintenance requirements – there are good reasons for seeking to use electric fire pumps. A basis of design pump for the prototype washeteria being discussed in this report might be an electric fire pump, U.L. listed, nominally sized at 200 GPM, and around 50 PSI

discharge pressure. This selection would lead to a motor horsepower of approximately 15 HP.

4. SUMMARY OF WASHETERIA RECOMMENDATIONS

A. Passive fire protection: the alternatives for increasing the passive fire protection in washeterias is described above. From the requirements of the IBC, it appears that upgrading the overall construction from a Type V-B to a Type V-A would be a substantial change, resulting in a major increase in cost and complexity of construction. We do recommend consideration of the following increases in passive protection in decreasing order of importance:
   i. Reduction of the use of exposed combustibles (protected with sheetrock or coatings).
   ii. Protection of soffits below the building with a product similar to G-P Gypsum ToughRock Soffit Board.
   iii. Provide a rated enclosure around all fired equipment, such as the building boiler room/mechanical room.
   iv. Fire stopping or use of fire retardant treated materials in attic and ceiling spaces (especially where sprinkler systems are planned).
   v. Allow contractors or builders the option of gypsum products or coatings for protection of surfaces and ratings. This will allow them to bid and use the most cost effective solution.

B. Active fire protection: the case for adding active fire protection to washeterias is more complicated than for passive protection. Active protection systems will provide early warning of fire conditions, and in the case of suppression systems, can control or even extinguish fires. The down side to these systems is cost, complexity, and maintenance needs. However, these systems may be the only way to address the losses in washeterias that have occurred (see Vol. 1 for discussion), by allowing emergency response while fires are still in their incipient phase, or to provide control or extinguishment if a fire occurs. Application of these active systems will not be without challenges as correct installation, proper operation, and maintenance will be more difficult in the remote environments. Where the construction budget permits, the following recommendations should be considered.
   i. Installation of a fire detection and alarm system throughout the building. A sample layout is provided in Figure B in the Appendix.
   ii. Installation of a wet pipe sprinkler system (with criteria as previously defined). Use of an electric fire pump and atmospheric storage tank are also recommended with the limitations previously explained. A sample layout is provided in Figure A in the Appendix.

APPENDIX

5. FACILITY DESCRIPTION

A. Clinics: rural health clinics provide the first opportunity for health care in many of the "road-less" communities throughout the state. Residents of these communities are isolated from regional hospitals and health centers by significant distances, climatic extremes, and geographic barriers. Therefore, these clinics provide a critical service to rural residents, as the initial access into the state-wide health care system. Rural clinics are typically staffed with a Community Health Aide/Practitioner, although some have mid-level providers and itinerate clinicians.

B. Construction: the basis for this report is the Denali Commission/ANTHC prototype Large Health Clinic. ANTHC provided the design documents to be used as the basis for the code analysis and recommendation sections of the report. The size of the prototype clinics varies from the "small" version at 1,500 square feet, up to the large version (the basis for this report) at 2,500 square feet. All versions are single story construction. In general, clinic construction is of wood framing or use of foam insulated panels. Foundation design is based on site conditions but can be of pored concrete footing with treated wood foundation walls and a crawlspace, a post and pad foundation, a piling foundation, or a triodetic foundation system. The structural frame system options consist of a conventional framing system (TJI floor joists, wood frame walls, and scissor roof trusses). Most construction materials including flooring, roofing, and wall framing are of combustible construction. Structural members are not normally provided with a fire resistive treatment. No rated assemblies are provided in the facility. A typical list of rooms present in the clinic might include the Laundry/Storage, Specialty Dental, Exam Room, Office, TDY/Kitchen, Behavioral Health/Community Service Office, Waiting, Pharmacy Storage, and Restroom. A floor plan can be found in the Figures at the end of the Appendix.

C. Locations: there are more than 115 estimated clinics located in Alaska (not including rural hospitals, or sub-regional clinics). Rural health clinics are typically found throughout the state in communities of 700 residents, or less. A useful reference for work at rural clinics is the Denali Commission's interactive project database. The website can be found at www.denali.gov, and the use should go to the "Project Database".

D. Occupancy/usage: the primary occupants of clinics are the staff and the patients (and those accompanying the patients). Hours of operation vary from community to community but the facilities are typically open normal business hours. Persons with disabilities may also be present to use the clinic. The clinic design includes a temporary quarters room to allow itinerate clinicians to sleep in the clinic overnight. Note that no surgery is

expected to be performed, and patients do not spend the night in the clinic.

E. Community Infrastructure: rural communities typically have limited infrastructure and rudimentary utilities. Power is typically supplied via a utility co-op using diesel generators, while water and sewer service may be limited to public buildings in the community center.

F. Fire protection features: as described above under “construction”, there is very little passive fire protection built into current designs as it is commonly not required by the code. Most materials are combustible, and no fire separation assemblies are shown as part of the prototype design. No known facilities are protected by automatic sprinkler systems or other automatic fire suppression. The prototype design recommends the use of a fire detection and alarm systems, but the prototype drawing shows only a partial system – with detectors located in certain areas only.

G. Denali Commission: this organization offers a grant program tailored to the renovation or new construction of rural health clinics. In concert with this program, the Commission desires to add fire protection systems and fire resistant construction, in order to protect the community investment into these new or renovated facilities. This report addresses many of the considerations the Commission must take into account when incorporating fire protection into facilities located in rural communities.

6. CODE ANALYSIS

A. Codes used in analysis and for comparison: although only a single code is promulgated by state law in Alaska, there are other codes which can be used for guidance or comparison when fire safety issues are considered. The codes which address fire safety for buildings is the International Code Council series of codes, a replacement of the Uniform series of codes which have been used in the State since state law first addressed the issue. On 6/25/01, 13 AAC 15.010 was amended to make use of the new 2000 International Fire Code, the 2000 International Building Code, the 2000 International Mechanical Code, and the 2000 Uniform Plumbing Code. Other codes which can be used for guidance and comparison include the following:

i. 2000 NFPA 101 Life Safety Code. Note that NFPA 101 stresses life safety over property protection, which is a different approach than other model codes.
ii. 2003 NFPA 5000 Building Code (currently in draft form).

B. Occupancy and construction classification: note that since the approach taken by each of the model codes is different, direct comparisons can be difficult. However, for each of the code options discussed here, an occupancy classification and construction classification equivalent is presented for a clinic. All of the codes described here put few restrictions on the construction – either the materials of the structure, or fire rated protection of the structure. The codes are arranged in order of applicability – the first code listed is the code currently required for new design.

TABLE 1: Clinic Code Criteria for Occupancy & Construction

	2000 IBC/IFC	NFPA 101	NFPA 5000	Comment
Occupancy	B	Business	Business	
Construction	Type V-B	No minimums	Type V, 000	Minimum req. constr.

C. Allowed area/construction: as can be seen by Table 1 above, there are few restrictions on construction type for clinics. This means that any permitted building material (including wood) can be used, and no fire rated protection of the structure is required. The way the model codes are arranged is that the function and type of construction are used to determine the maximum building area allowable for those two criteria. If the area desired exceeds that permitted by the codes, then a more restrictive construction type is needed. For example, if the desired area for a building of type V-B is exceeded, the project might be able to proceed using a V-A construction type. Following are tables for the model codes as they relate to allowable area for the least stringent construction types allowed shown in Tables 1 and 2. The net result is that the codes have similar area limitations at around 9,000 square feet using the least stringent construction type.

TABLE 2: Allowable Area (square feet)				
	2000 IBC/IFC	NFPA 101	NFPA 5000	Comment
Clinic	9,000	N/A*	9,000	

*No restrictions on area.

D. Required fire protection features: the model codes establish certain conditions under which fire protection features are required. These features would include portable fire extinguishers, fire detection and alarm systems, and fire suppression (sprinkler) systems. These conditions can be based on occupancy, height, number of stories, or other factors. For the table below, we have assumed the typical clinic construction. For example, in most cases, the IBC would require an automatic fire suppression system to be installed where the occupancy is classified as "H" – or hazardous. For the clinics, the codes require portable fire extinguishers, but no fire alarm or sprinklers.

TABLE 3: Required Fire Protection Features				
	2000 IBC/IFC	NFPA 101	NFPA 5000	Comment
Clinic	PFE*	PFE*	PFE*	

* PFE = Portable Fire Extinguisher

7. ALTERNATIVES

A. Additional passive features: one possible approach to increase the fire protection aspects of new construction is to increase the passive fire protection features of the building. Passive fire protection refers to elements of construction which will make the facility less susceptible to fire without active intervention. These features could include use of non-combustible construction materials, non-combustible finishes, fire rated protection of structural elements, and increased fire rated separations within the facility. The value of these options would be the reduced chance of incipient fire, the reduction in ready fire spread when a fire is ignited, and protection of the structure during a serious fire – allowing more time for firefighting operations.

B. Fire detection and alarm options: as was noted previously, the application of fire detection to clinics has been varied in the past. The addition of a detection and alarm system could provide more rapid detection of a fire, allowing firefighting to occur much earlier in the fire development. This can be critical when the local fire department has limited resources as is often the case in rural communities with clinics. As with any active system, system maintenance will be required and this can be a challenge in remote communities where skilled personnel are not readily available.

C. Fire suppression alternatives: there is no known instance of a rural clinic that is protected by a conventional automatic sprinkler system. Conventional sprinkler protection should be considered. Some possible suppression alternatives can be found in Volume 1 of this report (for washeteria fire protection – the available alternatives for clinics are the same).

D. Operations and maintenance cost ramifications: increasing the fire protection features of clinics will have an impact on construction cost, but will increase operations and maintenance costs as well. For passive protection features, the impact will probably be minor, but sheetrock finishes and structural member protection will be more fragile than finishes currently used. For fire detection and alarm systems, annual inspection and occasional maintenance and repair will be needed. Since the technical support will probably not be locally available, a special trip to the community will have to be scheduled to keep the system in good operating condition. For suppression systems, a similar level of inspection and maintenance will be needed. Wet pipe systems are required to be inspected on an annual basis, and dry pipe systems require inspection every 6 months. Since a number of community schools have sprinkler systems, it would be possible to combine the clinic inspection with the technician visit to the school to save money. There is also the possibility

of damage resulting from vandalism or accidental discharge of suppression systems. The costs for the inspection and maintenance of these systems must be considered along with the normally expected operating costs. The most effective fire protection features can be rendered inoperative by insufficient maintenance.

8. RECOMMENDATIONS

A. General: the first question that occurs when reviewing the fire protection features present in current clinic design is whether or not additional fire protection features are needed. Since this report's scope did not include research on loss history for clinics, there is not a body of evidence to draw from for recommendations. The factors that should be considered when weighing additional fire protection are the cost of the facility, the complications in replacing the facility if it is lost or damaged, and the effect on the community if the facility becomes unusable due to fire. One if the issues could be available funding for repair or replacement if a fire were to occur, as well as the time it would take to rebuild. When these factors are considered, the additional expense and increase in complexity that results from improving fire protection could provide good value.

B. Alternative discussions: as previously discussed, the options available to improve protection from fire come from three areas – passive fire protection, fire detection and alarm, and fire suppression. Increasing the protection in each of these areas must be weighed against the increased cost, the increased complexity, and the increased expense of system maintenance. These issues could be evaluated through the use of life cycle costs. Due to the variation between communities in terms of clinic design, maintenance personnel, cost of travel to the community, and available fire department response – it is difficult to generalize and make a blanket recommendation for all clinics, but we have some suggestions as follows:

i. Passive fire protection – we recommend that all clinics be considered for improved passive fire protection. This would include a reduction or elimination of combustible surfaces and finishes, protection of structural members with fire rated treatment, and the use of non-combustible construction materials should be considered. The maintenance of these types of materials will be more costly and more frequent than plywood finishes, but can probably still be accomplished with locally available labor. A possibility would be to upgrade the construction type to V-A (IBC 2000). An example of a possible material for use in protecting exposed soffits would be the G-P Gypsum ToughRock Soffit Board.

ii. Fire Detection and Alarm System (FDAS): there are two primary values to the installation for a fire detection and alarm system, and those are the notification of occupants of a fire condition to allow evacuation, and notification of firefighters to allow for rapid response. To reduce the severity of fire loss, the notification aspect of the FDAS could be used to alert the local fire department or other officials. Since the firefighting capability varies so widely among communities, our

recommendation is that for communities with an organized fire department or a planned response for fire, that fire detection and alarm systems be installed with exterior horns and strobes, and where possible, with remote annunciation of fire conditions. This remote location could be a fire department (where present), a Village Public Safety Officer, a community official, or even to a pager. Where organized response to a fire is not available, an FDAS may still be useful, but may not increase the fire protection of the facility to the same extent. A sample layout of a fire detection and alarm system is provided in Figure D in the Appendix.

iii. Portable fire extinguishers: as a first line of defense against incipient fires, we recommend that all clinics have portable fire extinguishers. This is actually a code requirement under the 2000 IBC/IFC and under NFPA 101. We would recommend that the extinguishers be provided in accordance with NFPA 10 - Standard for Portable Fire Extinguishers, 2002 Edition.

C. Fire suppression recommendations: a number of suppression options were previously discussed in Volume 1 of the report. The options based on something other than water are probably not practical for reasons of complexity and cost – the cost being both initial construction cost and maintenance. These options that are not recommended include dry chemical, carbon dioxide, Halon, and other gaseous agents (FM-200, Inergen). Water-based systems are probably the best choice for rural fire protection on the scale needed for clinics. Water fire suppression systems are usually relatively simple, reliable, and have an excellent record for successful operation. When fire suppression is judged to be a useful feature, we recommend a wet pipe sprinkler system using criteria similar to that described previously for washeterias. A sample layout of a sprinkler system is provided in Figure C in the Appendix.

D. Issues for future consideration: there are a number of other areas where fire protection for clinics could be improved for both new and existing facilities. Some of these ideas are noted below for consideration for both existing and new facilities:

i. Ignition control: although smoking may not be much of an issue at clinics, it can be a contributing factor to fires (NFPA reports that smoking materials are the leading cause of fire deaths in the United States). We suggest a control of possible ignition sources in clinics including smoking and open flames.

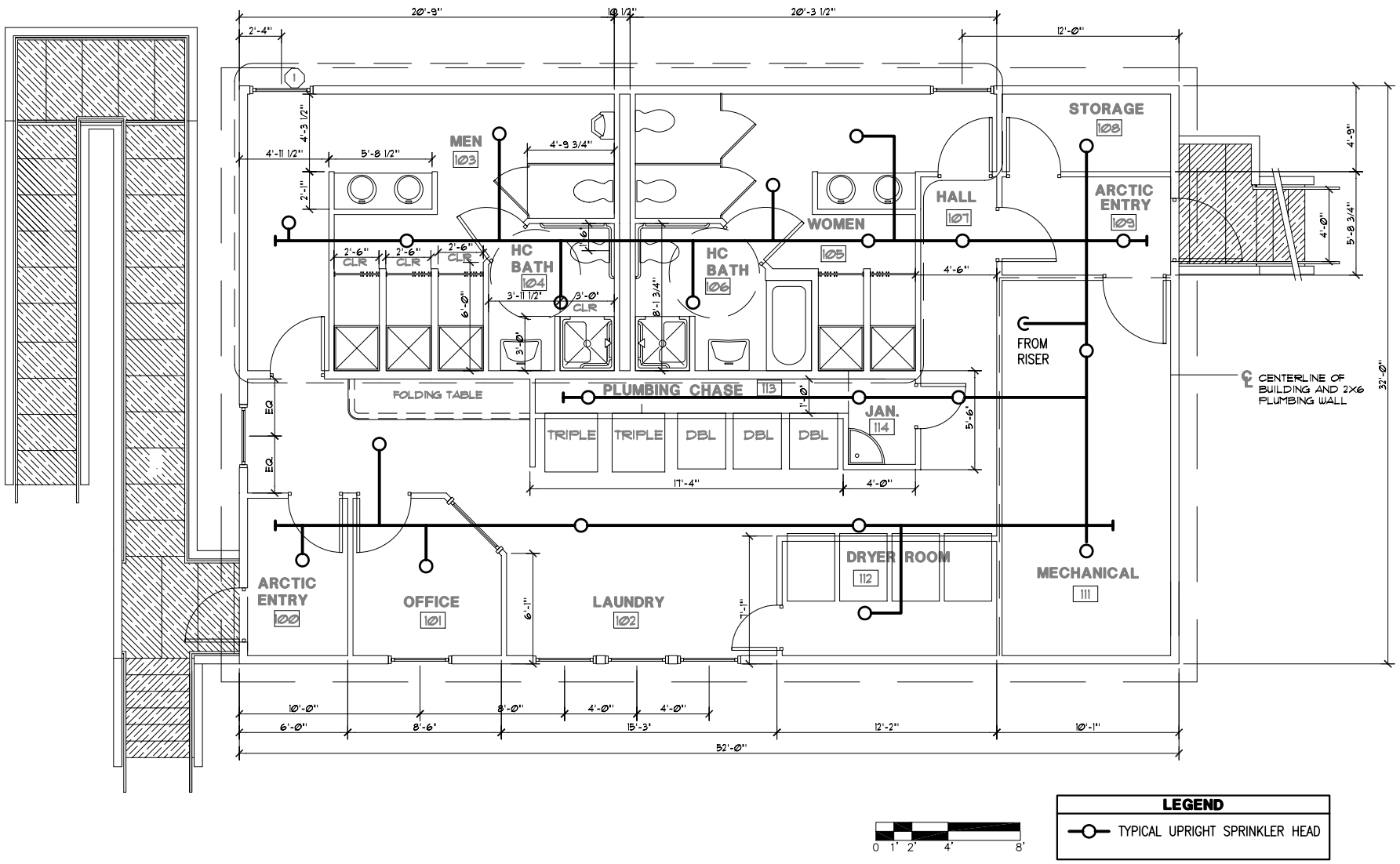
ii. Inventory and condition survey: we suggest that a plan be put in operation for qualified personnel to visit each of the existing clinics to observe the conditions, and to make recommendations for improving the fire safety aspects of the facilities.

iii. Inspection services: we recommend that an ongoing effort be made to observe the condition of clinics, and especially to monitor fire

protection features of the building. This could be done on an annual basis, and it may be possible to involve the State Fire Marshal when their personnel travel to the community schools for inspections.

iv. Insurance requirements: there may be a way to involve other parties in the goal of achieving lower fire losses. One possibility is to ensure that facilities are insured for loss from fire. When this requirement is met, a 3rd party – not the community and not ANTHC or a governmental agency – will have an interest in a well-maintained, fire safe building and could provide expertise in analysis, and prevention. It would also provide a funding source for repair or replacement if a substantial loss occurs.

9. ATTACHMENTS
   A. Typical drawing of washeteria sprinkler system.
   B. Typical drawing of washeteria FDAS.
   C. Typical drawing of clinic sprinkler system.
   D. Typical drawing of clinic FDAS.



11-17-03	DESIGN:	**WASHETERIA SAMPLE SPRINKLER LAYOUT**
PROJ. No. A01017.12	DRAWN:	**WASHETERIA AND CLINIC FIRE PROTECTION-VOL. 2**
FIGURE A	CHECK: TJ	
	SCALE: AS SHOWN	

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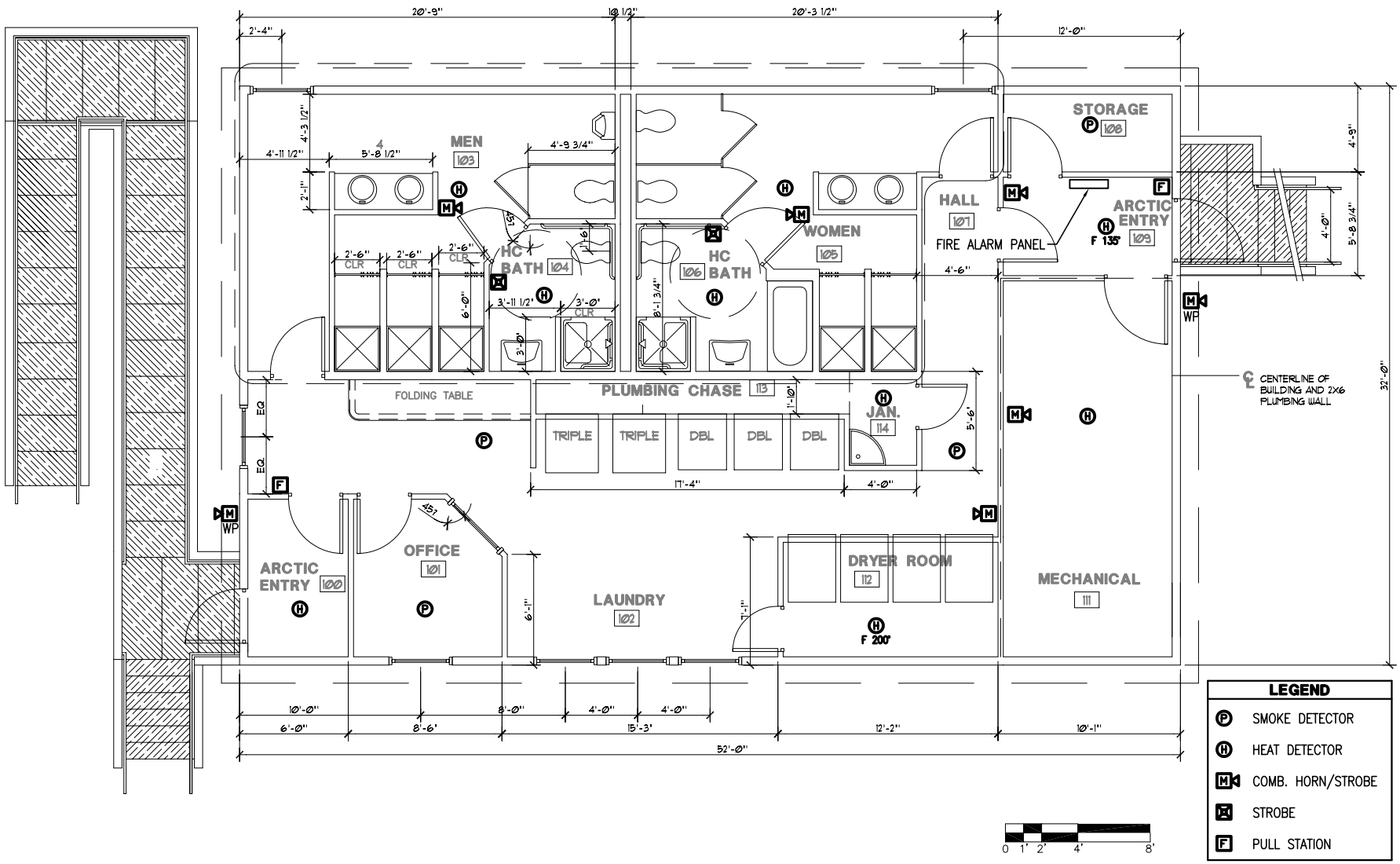

11-17-03	DESIGN:	**WASHETERIA SAMPLE FIRE DETECTION AND ALARM LAYOUT** **WASHETERIA AND CLINIC FIRE PROTECTION-VOL. 2**
PROJ. No. A01017.12	DRAWN:	
FIGURE B	CHECK: TJ	
	SCALE: AS SHOWN	

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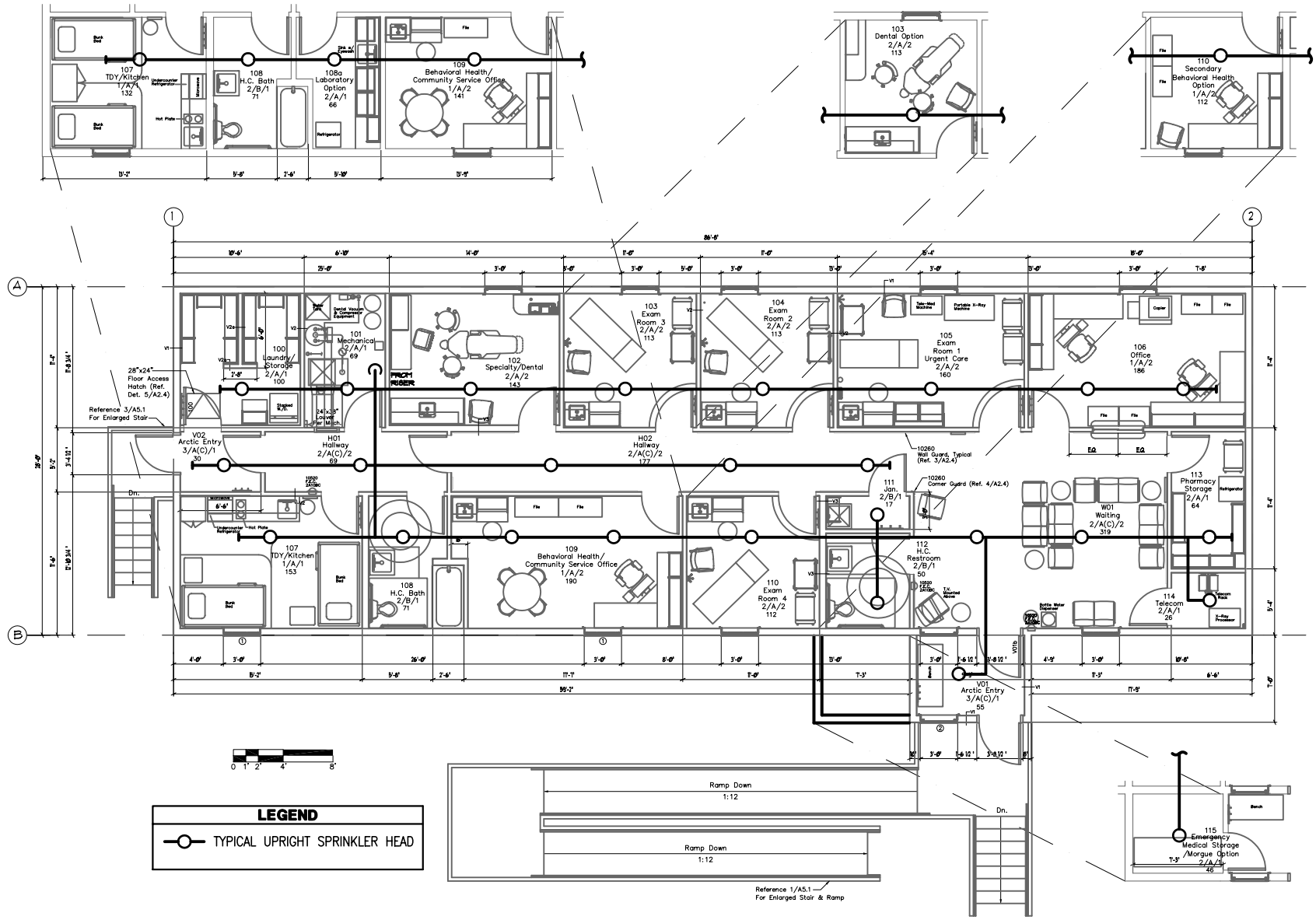

11-17-03 PROJ. No. A01017.12 FIGURE C	DESIGN: DRAWN: CHECK: TJ SCALE: AS SHOWN	**CLINIC SAMPLE SPRINKLER LAYOUT** **WASHETERIA AND CLINIC FIRE PROTECTION-VOL. 2**

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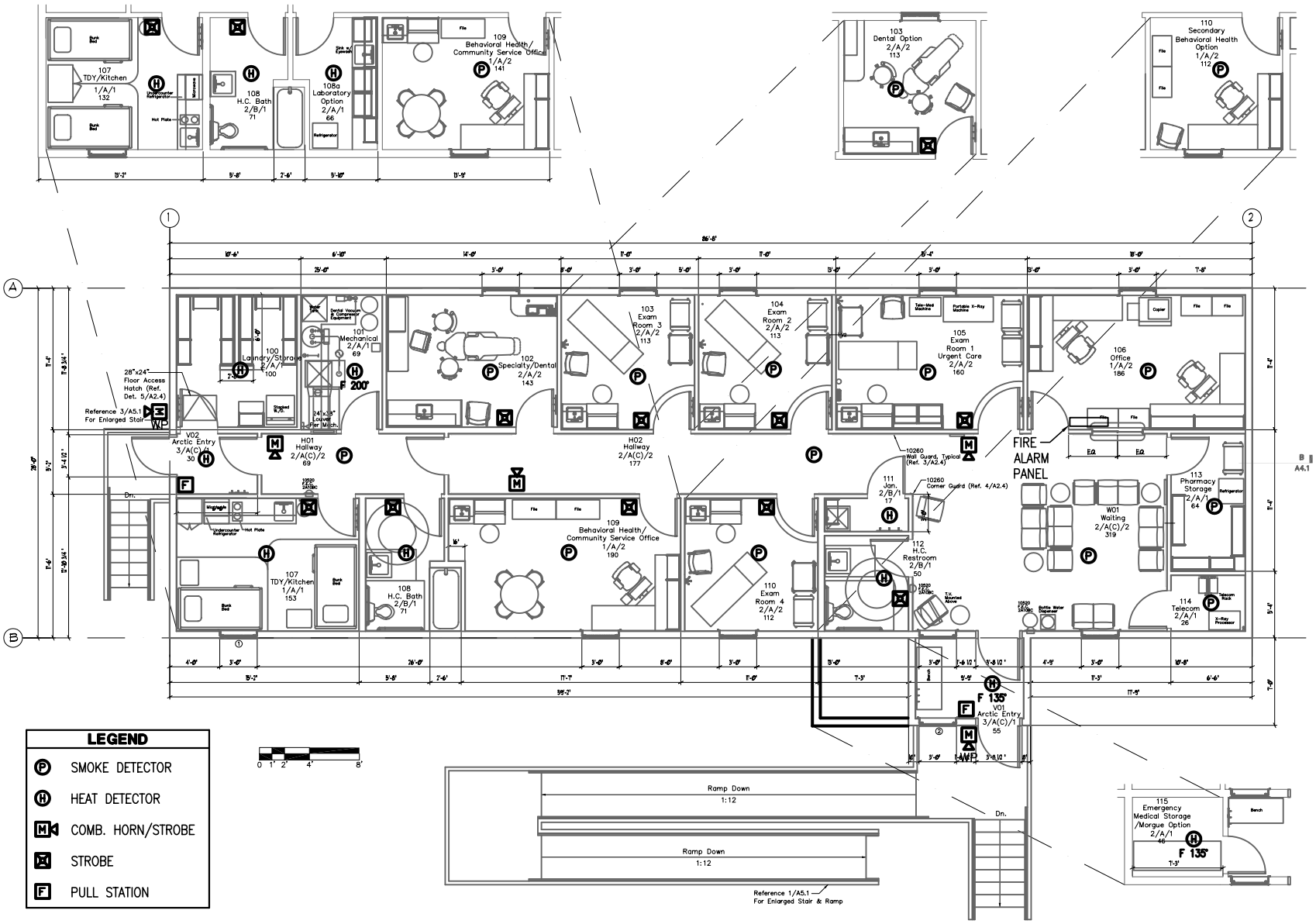

11-17-03	DESIGN:	**CLINIC SAMPLE FIRE DETECTION AND ALARM LAYOUT**
PROJ. No. A01017.12	DRAWN:	**WASHETERIA AND CLINIC FIRE PROTECTION-VOL. 2**
FIGURE D	CHECK: TJ	
	SCALE: AS SHOWN	

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